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(54) Abstract Title
Interactive display system

(57) An interactive display apparatus comprises an audio subsystem (4), a control subsystem (5) and a plurality of video subsystems (2, 3). The video subsystems (2, 3) have access locally to image data, including image files and live video. The video subsystems (2, 3) are controlled by the control subsystem (5) which then sends command messages to the video subsystems (2, 3). A person watching the display (22, 32) of one of the video subsystems (2, 3) can dial into the audio subsystem (4) and thereby control the operation of the video subsystem (2, 3). To do this, the audio subsystem (4) notifies the control subsystem (5) of incoming audio command signals. It is to be noted that when the system is on line, the control subsystem (5) does not transfer image data to the video subsystem (2, 3) but merely sends commands setting the format of the images displayed on the screens (22, 32).

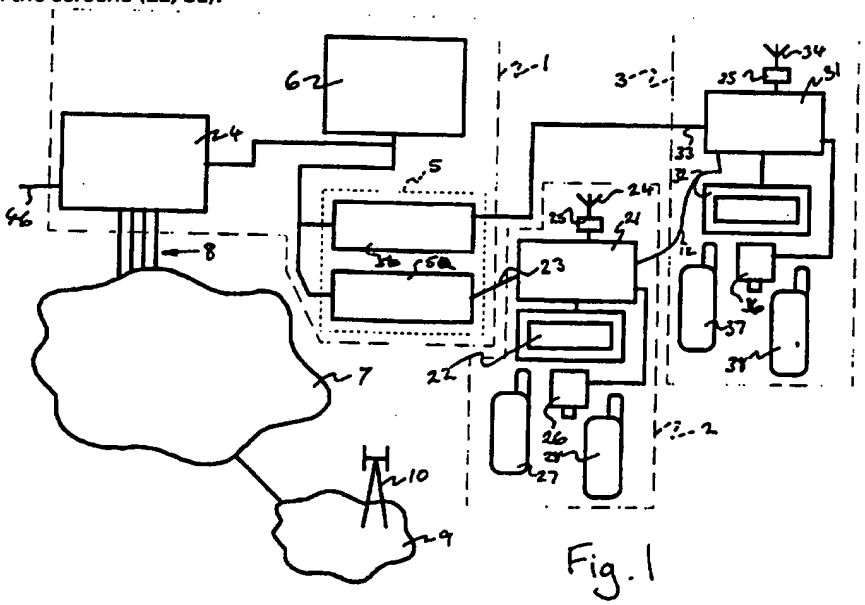

Fig. 1

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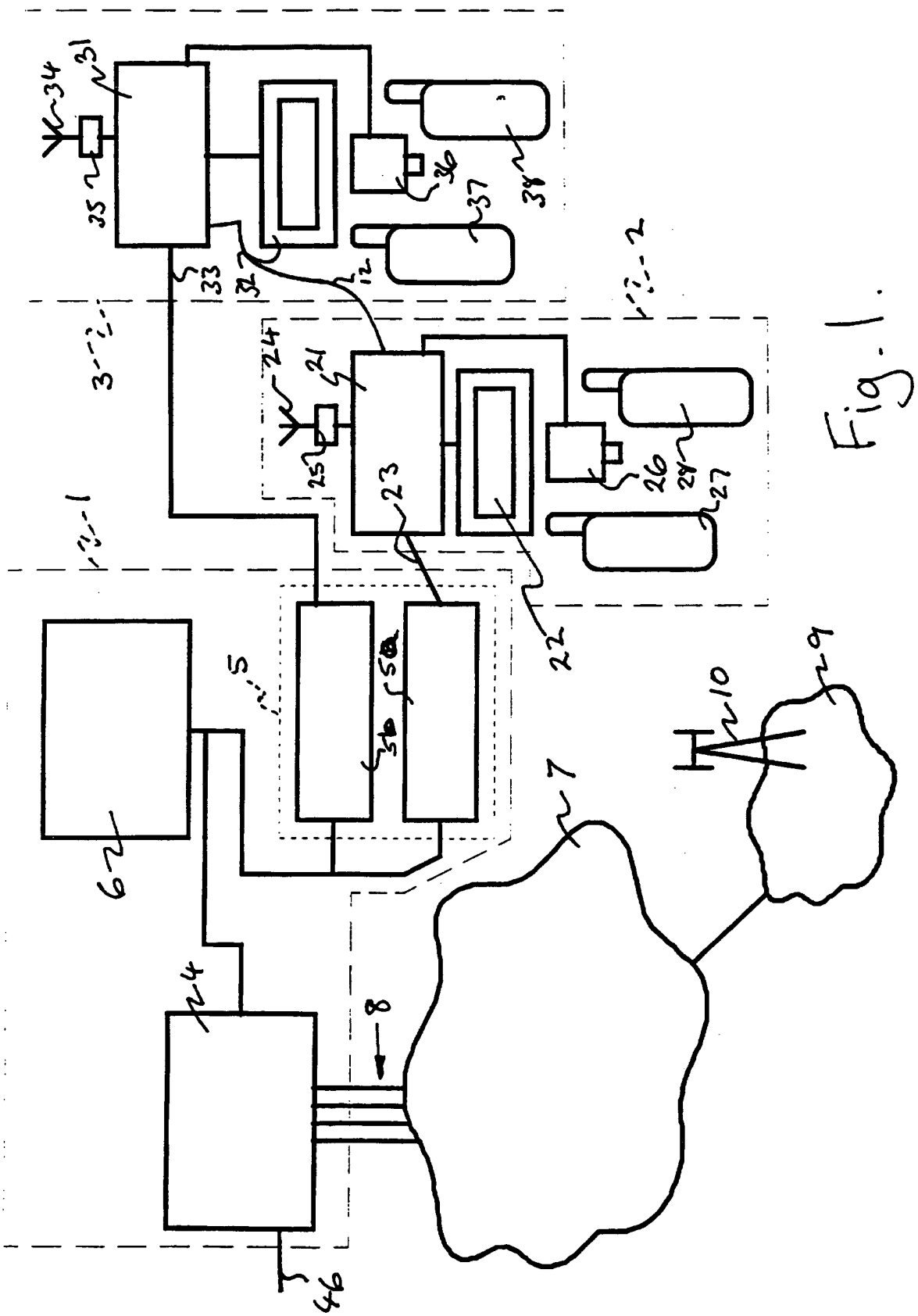

Fig. 1.

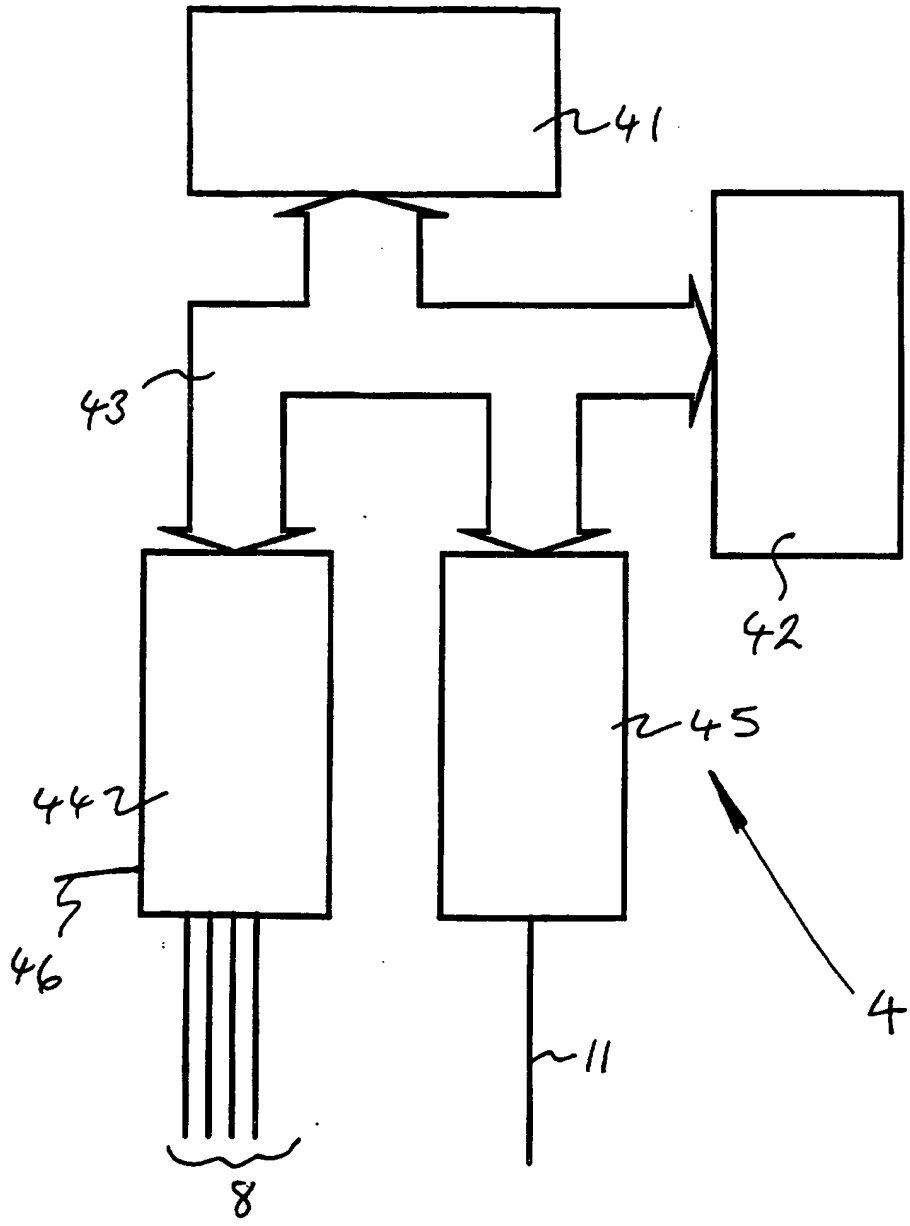

Fig. 2

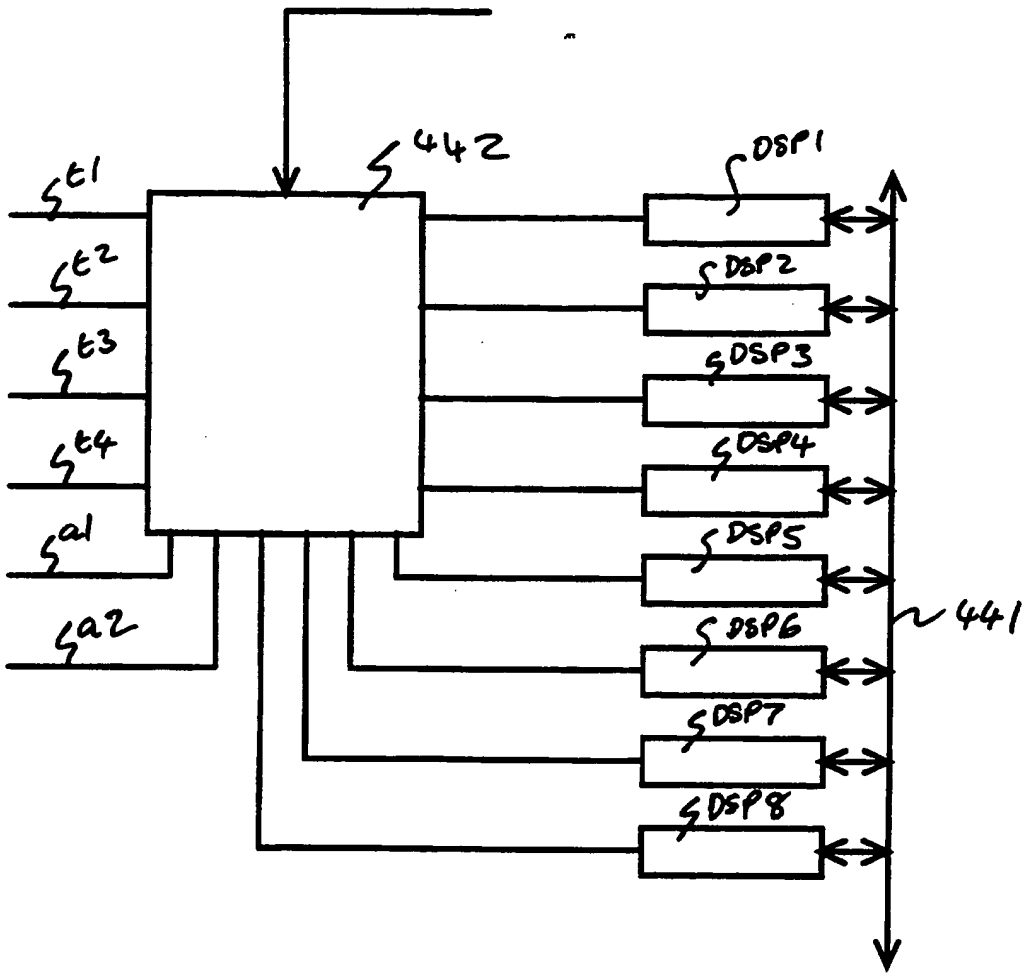

Fig. 3

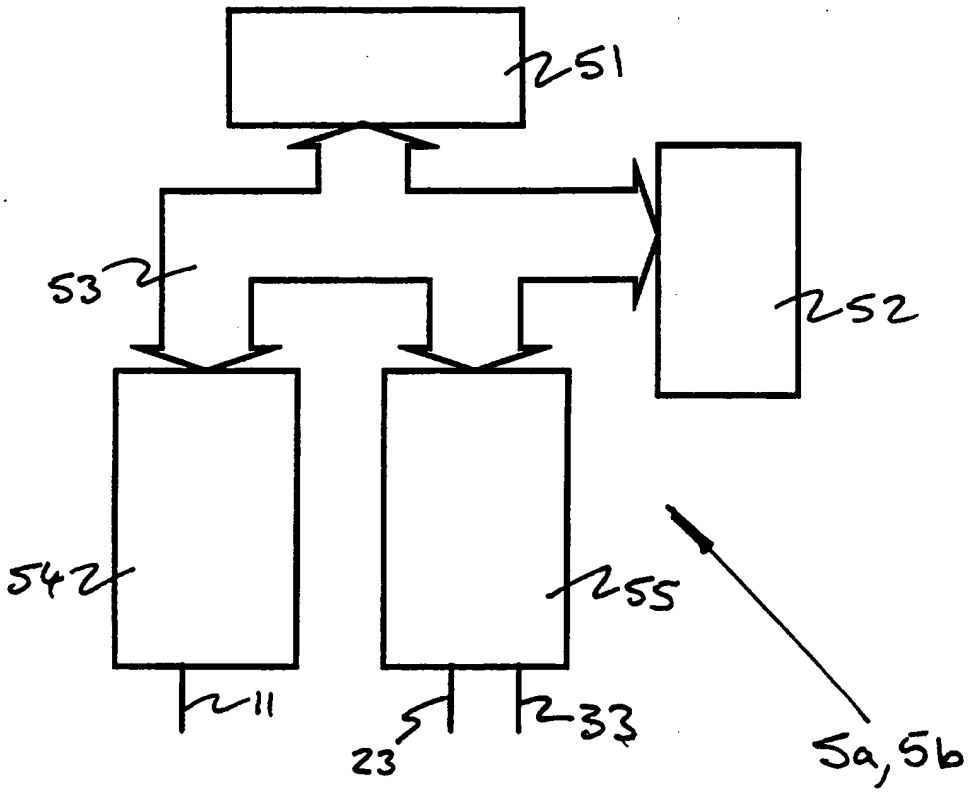

Fig. 4

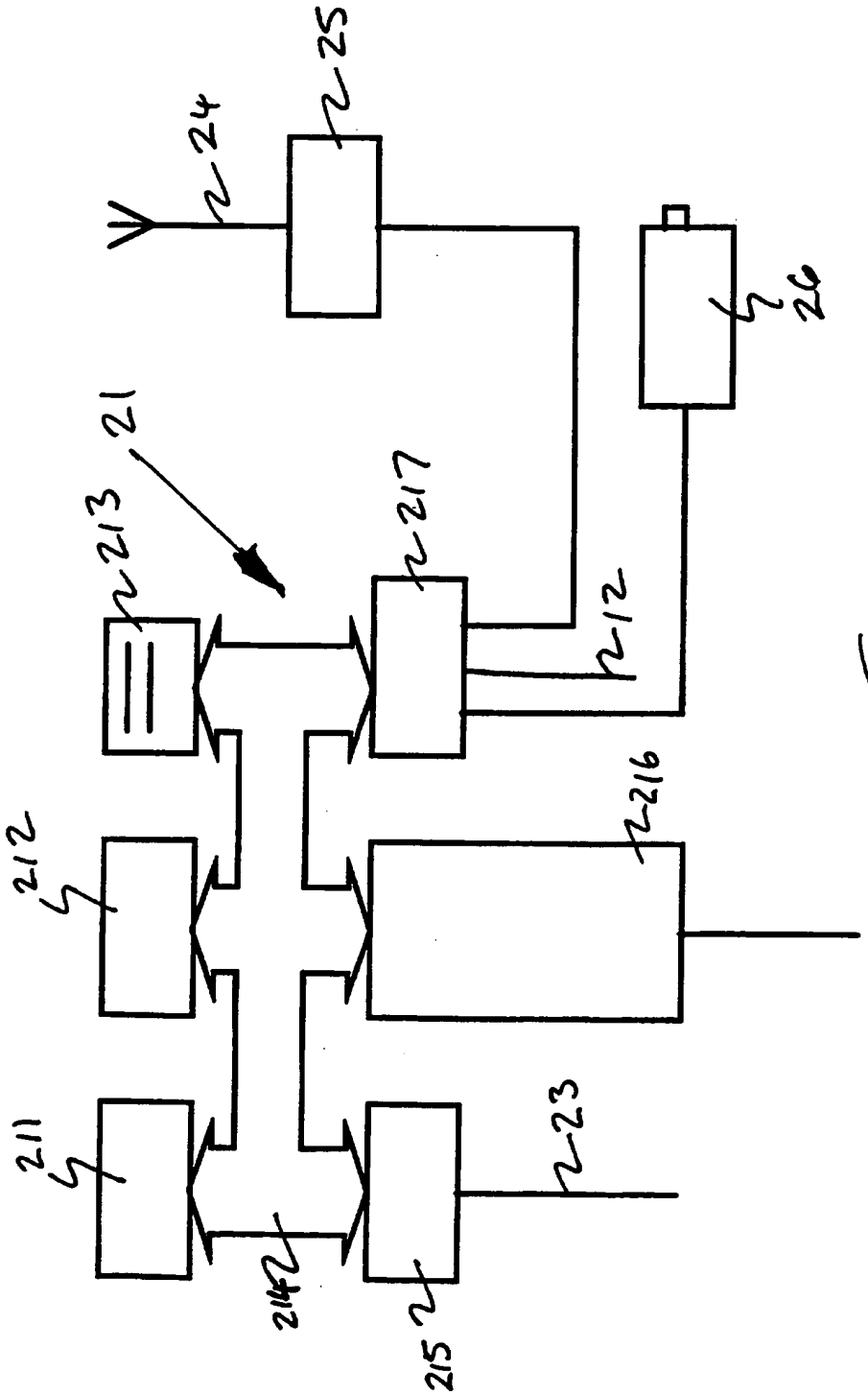

Fig. 5

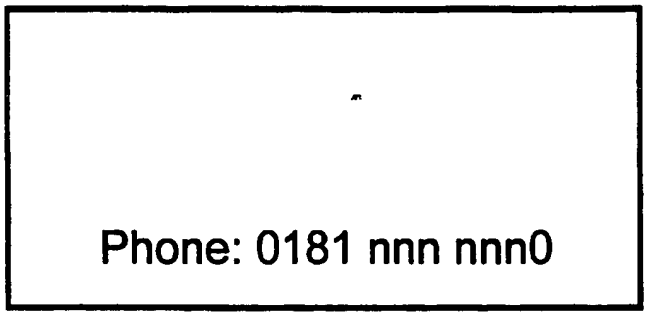

Fig. 6

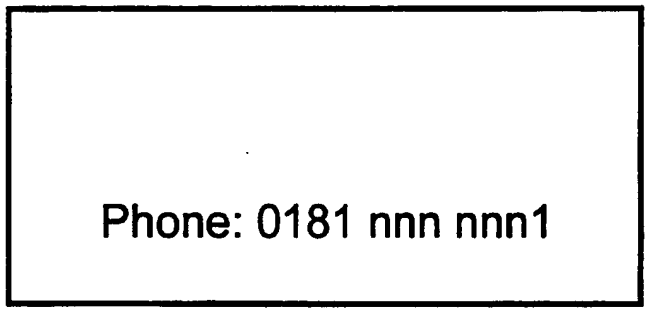

Fig. 7

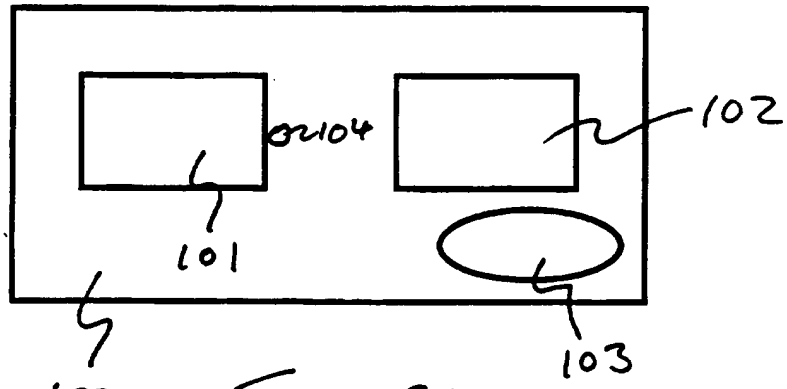

Fig. 8

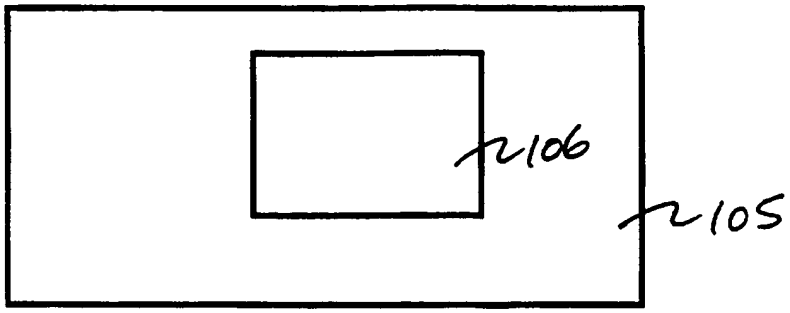

Fig. 9

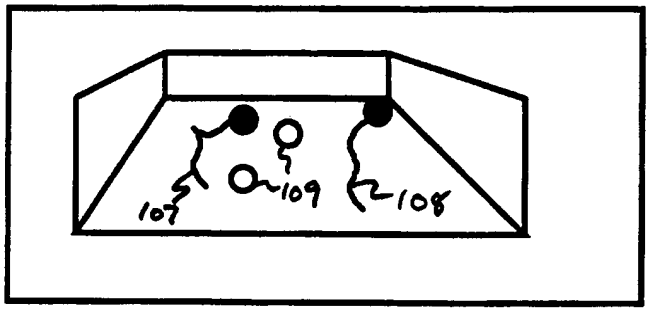

Fig. 10

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Interactive Display System

Description

The present invention relates to an interactive display system and an interactive display method.

The display of information in public places is most commonly provided using billboards. Billboards are essentially static, although in recent years billboards have been developed which cycle by electromechanical means through two or more images. Another development is the use of large video displays which are used to display advertisements, such as are produced for television but without sound, and to display information and action replays at sporting events.

A problem with these known display apparatuses is that the sequence of images, if any, is fixed. For the purposes of advertising, it is desirable that the viewer's attention be captured and retained. However, if the viewer is merely a passive recipient of a fixed sequence of images, the viewer soon loses interest and turns away.

According to the present invention, there is provided an interactive display system comprising: an audio subsystem configured for receiving audio communication signals via a wide area communications network and generating control signals in dependence on the received audio communication signals; a control subsystem configured to respond to said control signals from the audio subsystem by issuing display commands, and a video subsystem including display means, configured to be responsive to said display commands to display on the display means images defined by image data, wherein the video subsystem is remote from the control subsystem and said image data is provided to the video subsystem independently of the display commands.

According to the present invention, there is also provided an interactive display method comprising the steps of:

providing a supply of images data at a remote display station;
receiving at a central station an audio communication signal via a wide area communications network and generating control signals in dependence on the received audio communication signals;
issuing from the central station a display command to the remote station in dependence on the received audio communication signal; and
displaying an image at the display station in dependence on the display command, said image including a portion defined by image data from said supply.

It will be appreciated that the use of a wide area network means that subsystems of the present invention may be located in different jurisdictions. Therefore, the applicant seeks protection for a video subsystem of a telephone-controlled interactive display system including display means, configured to be responsive to display commands from a remote control subsystem to display on the display means images defined by image data, said image data being provided to the video subsystem independently of the display commands, and means for making available to a person viewing the display means a telephone number that can be called to establish an interactive relationship between said person and the display system using a telephone.

It will be appreciated that the present invention has applications other than the provision of an enhanced "billboard".

The use of a wide area communication network, for example the Public Switched Telephone Network and public land mobile networks, means that the display system operator does not need to provide input devices at the video subsystem because a user can use a mobile telephone or a convenient payphone. The payphones at railway terminuses and airports often only have a simple hood for providing a degree of privacy. Consequently, the payphone structure in such locations is not necessarily an impediment to viewing of the display.

Other wide area networks supporting audio communication, for example the Internet, may also be used.

The audio communication signals may comprise DTMF signals or speech signals, in which case the audio subsystem will be provided with speech recognition means.

It should be noted that, while the system is "online", image data is not transmitted between the control subsystem and the video subsystem. The display commands select images for display and define the positions in which they are displayed.

As the image data is not being sent from the control subsystem in response to audio communication signals, as in viewdata systems such as Prestel, it is preferred that the video subsystem include local data storage means storing said image data for display in response to a display command. However, this is not essential and the image data may be provided from a source of real-time video signals, such as a video camera or a television tuner. The image data may also comprise program data for producing an image. The program data may be such that the image as it is displayed is altered in dependence on signals from the control subsystem. The local data storage means may comprise solid-state memory, magnetic or optical disk or magnetic tape, or indeed any combination of these.

Conveniently, the transmission of the display commands requires a bandwidth insufficient for the transmission of real-time video. Video having a frame rate greater than twenty frames per second is primarily meant by real-time video. The display commands require a bandwidth far less than could conceivably be occupied by real-time video signals using compression techniques commercially available before May 1997. Conveniently, the control subsystem can be linked to the video subsystem by a communications channel having supporting a maximum bit rate of 64kbits s^{-1} as provided by an ISDN connection.

Preferably, the communication between the control subsystem and the video subsystem is session based rather than transaction based. Thus, in this preferred form the present invention operates in a manner quite distinct from the World Wide Web.

Having established an audio channel between a user and the audio subsystem, using for example a telephone, a resource is available for supplementing the video display with an audio capability. Preferably, therefore, the control subsystem is configured to respond to control signals from the audio subsystem by issuing audio subsystem control commands.

A problem with the use of large video displays for advertising is the lack of sound accompanyment, e.g. music or dialogue. Sound can be provided using loudspeakers. However, this is undesirable in public places. A preferred embodiment of the present invention addresses this problem. In this embodiment, the control subsystem is configured to respond to a control signal to issue both a display command for causing a moving image to be displayed by the video subsystem and an audio subsystem control command to cause the audio subsystem to make available via the wide area communications network audio signals for accompanying the moving image.

The audio capability may also be used to provide instructions to a user.

In a system having a plurality of video subsystems, the control subsystem may be implemented by separate a control process means for each video subsystem. The control process means may comprise different machines or separate software objects implemented on one machine. For large systems, a plurality of software objects may be implemented on each of a plurality of machines.

Preferably, each image configuration is controlled by means of a corresponding server. The appropriate server being used by a control process means for issuing display commands in response to control signals from the audio subsystem.

The audio subsystem may be configured to accept audio communication signals from a plurality of sources. If such a system has the audio capability referred to above, the audio subsystem is preferably configurable, under the control of the control subsystem, to send the same or different audio signals to each source.

According to the present invention, there is further provided apparatus comprising a display and processing means configured for controlling the display according to a stored program and user input commands input via a telephone network, wherein the user input commands comprise telephone dialling signals. Such apparatus may be used to enable a user to operate a menu system using their telephone. The apparatus may also be used for the playing of video games. If the apparatus is employed for games playing, it is preferred that the processing means be configured for controlling the display according to user input commands input contemporaneously from different sources via the telephone network.

According to the present invention, there is still further provided a videophone system for use with mobile telephones comprising: a first video subsystem including a display and a video camera and located in an area covered by a mobile telephone network; a second video subsystem including a display and a video camera and located in an area covered by a mobile telephone network; communication means for conveying signals from the video cameras between the video subsystems; and an audio subsystem configured for receiving first and second concurrent telephone calls from mobile telephones and providing an audio connection between said calls to enable the calling parties to converse.

According to the present invention, there is still further provided a telephony interface comprising connecting means for connection to a plurality of telephonye circuits, signal processing means for producing audio signals from audio signal data and switching means configured to selectively applying audio signals produced by the signal processing means simultaneously to a plurality of telephone circuits by means of the connection means.

Preferably, the switching means is configured to selectively connect telephony circuits to each other by means of the connection means. More preferably, the switch means includes processing means operating under the control of a program or programs, the program or programs defining a set of switching states of the switching means.

In this context, "telephone circuit" means a connected telephone call having the interface acting as terminal equipment.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a block diagram of the main components of a system embodying the present invention;

Figure 2 is a block diagram of the audio subsystem of Figure 1;

Figure 3 is a block diagram of the telephony interface of the audio subsystem of Figure 2;

Figure 4 is a block diagram of the hardware of the control subsystem of Figure 1;

Figure 5 is a block diagram of one of the video control processors of Figure 1;

Figure 6 shows the initial display format of the first video subsystem of Figure 1;

Figure 7 shows the initial display format of the second video subsystem of Figure 1;

Figure 8 shows a display format;

Figure 9 shows another display format; and

Figure 10 shows another display format.

Referring to Figure 1, an interactive display system comprises a control centre 1, a first video subsystem 2 and a second video subsystem 3. The control centre 1 comprises an audio subsystem 4, a control subsystem 5 and a management subsystem 6. The control subsystem 5 comprises first and second control processors 5a, 5b.

The audio subsystem 4 is connected to the Public Switched Telephone Network 7 by four telephone lines 8 and to a direct audio feed 46. The direct audio feed 46 comprises the sound channel or channels from a broadcast television signal. The Public Switched Telephone Network 7 is linked via a gateway mobile switching centre (not shown) to a public land mobile network 9 which includes a base transmitter site 10. The audio subsystem 4, the control processors 5a, 5b and the management subsystem 6 are interconnected by local area network 11.

The first video subsystem 2 comprises a video control processor 21 and a display screen 22, such as a Sony Jumbotron (RTM), controlled by the video control processor 21. The video control processor 21 is linked to the first control processor 5a by an ISDN connection 23. An antenna 24 for receiving television signals is coupled to the video control processor 21 via a tuner 25. A video camera 26 for sensing the scene in front of the display screen 22 is also coupled to the video control processor 21.

The display screen 22 is mounted in a public place within a cell of the public land mobile network 9, covered by the base transmitter site 10. Consequently, subscribers to the public land mobile network 9 can use their mobile stations 27, 28 while watching the display screen 22.

The second video subsystem 3 is similarly arranged at another location and comprises a video control processor 31, a display screen 32, such as a Sony Jumbotron (RTM), an antenna 34, a tuner 35 and a video camera 36. The video control processor 31 is linked to the second control processor 5b by an ISDN connection 33. Similarly also, subscribers to the public land mobile network 9 can use their mobile stations 37, 38 while watching the display screen 32.

A broadband link 12 is provided between the video subsystems 2, 3. The video signals from the cameras 26, 36 of each video subsystem 2, 3 are transmitted to the other video subsystem 2, 3 in real time over the broadband link.

By calling the audio subsystem 4, subscribers to the public land mobile network 9 can use their mobile stations 27, 28, 37, 38 to control the images displayed by the display screens 22, 32 and receive accompanying audio signals. The images may comprise video presentations, advertising or informational material, games that can be played using the keys of a mobile station 27, 28, 37, 38 or live video from a camera 26, 36 for conferencing.

Referring to Figure 2, the audio subsystem 4 generally comprises a microcomputer having a processor 41, memory 42 and an internal data and address bus 43. A telephony interface 44 comprises a pair of 4-channel analogue telephony cards and interfaces the audio subsystem 4 to the telephone lines 8 and the direct audio feed 46. A network card 45 is provided for communication with the control subsystem and the management subsystem 6 via the local area network 11.

Referring to Figure 3, the telephony interface 44 comprises eight digital signal processors DSP0, ..., DSP7, interconnected by a bus 441 which also provides a path for the exchange of data between the telephony interface and the processor 41 of the audio subsystem 4. The telephony card 44 has six input/output connections, four of which t0, ..., t3 (corresponding to channels "0" to "3") are to the telephone lines 8 and two of which a0, a1 are to the direct audio feed 46. Switching circuitry 442 is coupled to the digital signal processors DSP0, ..., DSP7 and the input/output connections t0, ..., t3, a0, a1. The switching circuitry is controllable to connect any of the input/output connections t0, ..., t3, a0, a1 to each other and to any of the digital signal processors DSP0, ..., DSP7. These connections can be effected independently for forward and return signals.

In the present embodiment, the control software for the switching circuitry 442 is configured to effect a subset of all the possible interconnections. The interconnections that are permitted are terms "groups" hereinafter. The definitions of these groups are as follows:-

multiplay group	any of digital signals processors DSP4, ..., DSP7 connected to one or more of input/output connections t0, ..., t3 solely for the output of signals from digital signals processors DSP4, ..., DSP7 to the telephone lines 8;
conference group	interconnection of two or more input/output connections t0, ..., t3;
live group	connection of input/output connections a0 or a1 to input/output connections t0, ..., t3 solely for outputting via input/output connections t0, ..., t3 signals input via input/output connections a0, a1.

For control purposes, there are considered to be four multiplay groups, "1", ..., "4" involving respectively digital signal processors DSP4, ..., DSP7, two conference groups, "5", "6" (however, there may be more or less), and two live groups "7", "8" involving input/output connections a0, a1 respectively.

Signals entering the interface from input/output connections t0, ..., t3 are always sent to respective one of digital signal processors DSP0, ..., DSP3.

The function of the audio subsystem 4 is to detect events on the telephone lines 8, pass event notifying messages (NEW_CONNECT, DISCONNECT, FILE_END, MULTI_PLAY_FILE_END, DIGIT_PRESS) to the control subsystem 5 (see Figure 1) and route output audio to the correct telephone line 8 under the control of the control subsystem 5. The meaning of these messages will become apparent from description of the operation of the present embodiment hereinafter.

Since incoming signals in channels "0" to "3" are always directed to a respective one of digital signal processors DSP0, ..., DSP3, events on the telephone lines are detected

by these digital signal processors DSP0, ..., DSP3. For the detection of events on the telephone lines 8, the audio subsystem 4 implements a state machine defined by program code stored in the memory 42. Each channel can be in any one of five states: IDLE, RING, ACTIVE, CONFDSP and SFP. A channel is in the IDLE state if it is not being used, for instance if the telephone line 8 associated therewith is in the on-hook state. Conversely, a channel is active if it is being used, for instance if the telephone line 8 associated therewith is in the off-hook state. The RING state occurs when a call is routed to one of the telephone lines 8 and persists until the telephony interface 44 places the line in the off-hook state. The CONFDSP state is used for channels which are not connected to telephone lines and whose digital signal processors are being used by a multiplay group. The SFP state indicates that a file playing on a channel cannot be interrupted and that some special action, such as going on-hook, may be required when the file finishes.

Each channel also has a group state. If a channel is member of a group, its group state is the number of the group of which it is a member. Group state "0" is used to indicate that a channel is not a member of any groups. When a channel is not a member of a group, it is configured so that audio may be output from its respective digital signal processor DSP0, ..., DSP3 to its respective telephone line 8.

It is desirable that the control subsystem 5 (see Figure 1) should not have to know about the actual implementation of channels and groups in the audio subsystem 4. Furthermore, as will be explained in more detail below, a plurality of control processes running in the control subsystem 5 may need concurrent access to the resources of the audio interface 44. Accordingly, the "real" channels and groups, implemented by the audio subsystem 4, are mapped by the audio subsystem 4 onto virtual channels and groups used by the control subsystem processes. The mapping is performed by means of virtual channel and group tables maintained by the audio subsystem 4.

By way of example, if a first call is received on the telephone line 8 associated with channel "1", the audio subsystem 4 associates real channel "2" with virtual channel "0" for the first control processor 5a. If, subsequently, a call is received on the telephone line 8, associated with real channel "0", the audio subsystem 4 associates the real channel "0" with virtual channel "0". When these calls are terminated, the virtual channels associated therewith again become available for mapping onto any real channel. Real channels "2" and "3" are for the second control processor 5b and are similarly mapped onto virtual channels "0" and "1" for second control processor 5b. It will be appreciated that this channel mapping can be expanded readily for mapping much larger numbers of real channels onto virtual channels for a larger number of control processors.

Conversely, if a control subsystem process commands the audio subsystem 4 to play an audio file on its virtual channel "1", the audio subsystem 4 retrieves the corresponding real channel, channel 0 in this example, from the channel table.

The mapping of each type of group is handled similarly. That is, each real group can be mapped onto the members of a predetermined subset of the virtual groups available for a control processor 5a, 5b. For instance, the first control processor 5a may have available, three virtual multiplay groups, "1" to "3", two conference groups, "4", "5", and one live play group "6".

Referring to Figure 3, the control processors 5a, 5b each comprise a microcomputer having a processor 51, memory 52 and an internal data and address bus 53. A network card 54 is provided for communication with the audio subsystem 4 (see Figure 1) and the management subsystem 6 (see Figure 1) via the local area network 11 (see Figure 1). An ISDN interface 55 is provided for communication with the respective video subsystem 2, 3 (see Figure 1).

The memory 52 stores program code for a multitasking operating system and application program code for a control process and a library of "interactive format

servers". The control processes, run on respective control processors 5a, 5b, are implemented as instances of the same software object. When a control process is run, the management subsystem 6 sets its controlled video subsystem property to a unique value, in this case either the first or the second video subsystem 2, 3, and sets its initial interactive format server property.

Each member of the library of interactive format servers defines one display format for a display screen 22, 32, and includes responses to various events and identification accompanying audio files.

When, for example, the control process is instructed to cause a display format to be used, it calls the appropriate interactive format server which returns initial format definition data. The control process transmits the format definition data to the respective video subsystem 2, 3. The interactive format server will also usually return audio command messages which are sent to the audio subsystem 4 by the control process.

The control process responds to messages from the audio subsystem 4 and the respective video subsystem 2 by passing on the messages to the interactive format server and then sending any messages returned from the interactive format server to the audio subsystem 4 or the respective video subsystem 2, 3 as necessary.

The set of control process to audio subsystem messages comprises:

sPlay *ch filename*	start a single user file playing to channel *ch*
sStop *ch*	stop a single user file play on channel *ch*
conf *ch grp*	Add channel ch to conference group *grp*
deConf *ch*	Remove channel ch from conference group *grp*
live *ch*	Add channel *ch* to the live group
deLive *ch*	Remove channel *ch* from live group.

mStart *grp filename [ch ...]*	Start a multiplay group with the specified id, playing the file *filename* to the channels specified in the remaining args (if any). If group already exists, just start the file and add members.
mAdd *grp ch [ch...]*	Start a multiplay group with the specified members. If group already exists just add members.
mRemove *grp ch [ch...]*	Remove members from the specified multiplay group.
mStop *grp*	Stop the file being played on the multiplay group.

The set of control process to video subsystem messages comprises:

<L:G:*n1*:*n2*>	Make group n1 be in the biggest video window, and n2 in the smallest video window.
<F:V:g:+:*file*>	Play the filename in group g.
<F:V:g:->	Stop the video being playing in group g.
<U:*ch*:g:+>	Add user ch to the group g. (represent on screen that the user is in group g.
<U:*ch*:g:->	Remove user ch from group g.

The groups referred to in the control process to video subsystem messages are not those referred to in the control process to audio subsystem messages.

Referring to Figure 4, the video processor 21 of the first video subsystem 2 comprises a microcomputer having a processor 211, memory 212, a large capacity hard or optical disk drive 213 and an internal data and address bus 214. An ISDN card 215 is provided for communication with the first control processor 5a of the control subsystem 5 (see Figure 1). The TCP/IP protocol is used for communication between the video processor 21 and the first control processor 5a. A video card 216, including video RAM, is provided for driving the display screen 22 (see Figure 1). A multimedia I/O unit 217 is provided for receiving video signals from the camera 25 and from the antenna 24 via the tuner 25. The antenna 24 and tuner 25 could be

replaced by a video tape recorder. The multimedia I/O unit 217 also enables the video from the camera 25 to be output to the broadband link 12 and video from the broadband link 12 to be received for display.

The disk drive 213 stores still and moving image files, for instance files in JPEG format or MPEG format, for use in the display. The antenna 24 and the tuner 25 are configured for receiving broadcast television programmes. The tuner 25 may include decryption means so that encrypted transmissions can be received.

When the video processor 21 receives format definition data from the first control processor 5a, it interprets the received data and sends corresponding commands to the video card 216 to construct the static elements of the display. The display may be subsequently modified with dynamic elements in response to messages from the control subsystem. It should be noted that the static elements may comprise moving images, for instance a looping video, and the dynamic elements may comprise still images which are dynamic in the sense that they can be constructed or hidden dynamically.

The video processor 21 also continually routes the video from the camera 25 to the broadbank link 12.

The management subsystem comprises a conventional microcomputer configured for use on a local area network. The microcomputer is programmed to perform management tasks such as data logging. An operator can also control the audio and control subsystems 4, 5 from the management subsystem 6. The management subsystem is also used to set the order in which display formats are used. The nature of this programming will become apparent from the following description of the operation of the present embodiment.

The operation of the present embodiment will now be described using exemplary display formats and user actions and with reference to Figures 1 to 10.

The first stage in the operation of the present embodiment is the off-line configuration of the control processors 5a, 5b, the audio subsystem 4 and the video subsystems 2, 3. Each video subsystem 2, 3 will be required to produce a number of displays. Some, if not all, of these will require still or moving image files and these files must be loaded into the disk drives 213 of the video processors 21, 31. To do this an operator uses the management subsystem 6 to instruct the control subsystems to transmit the files to the video subsystems 2, 3 from a storage device (not shown) via the ISDN links 23, 33 during system downtime. Similarly, the operator uses the management subsystem 6 to instruct the control subsystem to transfer audio files for accompanying the pages from a storage device, which may be at the management subsystem 6, to the audio subsystem 4. It is to be noted that the image files are transferred while the system is off-line. Accordingly, video files can be transmitted using a much greater time than their playing time, thereby reducing the bandwidth required for their transmission.

Once the audio and video resources have been distributed, the operator uses the management subsystem 6 to instantiate the control process for each of the video subsystems 2, 3 and set the order of the display formats for each video subsystem 2, 3. The control processes are instantiated with their video subsystem properties set to indicate the first and second video subsystems 2, 3 respectively and initial interactive format server property values corresponding to the initial display format for the respective video subsystem 2, 3.

When the control processes are instantiated, they make calls to their interactive format servers for the initial display formats of the first and second video subsystems 2, 3 respectively. The format definition data for these display formats is returned to the control processes and then dispatched to the video subsystems 2, 3.

When the first video processor 21 receives the format definition data for its initial display format, its processor 211 stores it in the memory 212. The processor 211 then

generates commands for the video card 216 on the basis of the format definition data. The video card 216 responds to these commands by generating the image on the display screen 22. In this case, the initial display comprises simply a field of colour with an invitation to call a telephone number, as shown in Figure 6, so it is not necessary to retrieve any background image files from the disk drive 213 or include video from the tuner 25 or the camera 25. However, the initial display could include moving or still images if the designer so wished.

The second video subsystem 3 operates in the same way as the first video subsystem 2 to produce its initial display. In the present embodiment, the initial display format of the second video subsystem 3 is the same as that of the first video subsystem save that the telephone number displayed differs (see Figure 7). The telephone numbers differ so that the audio subsystem 4 can determine which display screen 23, 33 a public land mobile network subscriber is seeing.

While the initial displays are being set up at the video subsystems 2, 3, the audio subsystem 4 is instructed to start up by the management subsystem 6. During start up, the audio subsystem 4 initialises the channels, establishes network connections to the control processors 5a, 5b.

The system is now online.

A first public land mobile network subscriber takes up the invitation to call the number displayed by the first video subsystem 2 using his mobile station 27. The call is routed through public land mobile network 9 and the Public Switched Telephone Network 7 to one of the lines 8 into the audio subsystem 4. The state of channel "0", corresponding to the line, consequently changes from IDLE to RING.

The telephony interface 44 responds to the call by generating an off-hook signal. This places channel "0" in the ACTIVE state. When channel "0" enters the ACTIVE state, the processor 41 of the audio subsystem 4 first identifies the called number,

either using direct dial in (DDI) or from the channel number, if each line 8 is reached by only one telephone number. From the called number, the processor 41 identifies the video subsystem 2, 3 from which the call was made and consequently the control processor 5a, 5b to which messages should be sent. Having identified the first control processor 5a, the processor 41 makes an entry in the channel table linking real channel "0" to the first free virtual channel associated with the first control process 56, in this case virtual channel "0". Finally, a NEW_CONNECT message is sent to the first control processor 5a by the processor 41.

The first control process receives the NEW_CONNECT message and passes the NEW_CONNECT message to the interactive format server for the first video subsystem's initial format. The interactive format server determines that the response to a NEW_CONNECT message is a jump to another display format called "Tweeny1". Accordingly, the interactive format server returns a jump command, with Tweeny1 as a parameter, to the first control process 56.

On receiving the jump command, the first control process calls the interactive format server for display format "Tweeny1" which is the next display format in the schedule provided by the management subsystem 6. This returns the format definition data for "Tweeny1" which is then sent to the first video subsystem 2. The interactive format server also returns an instruction to the audio subsystem 4 requiring it to play a welcome message file to the calling subscriber. This message is sent to the audio subsystem 4 causing the telephony interface to play the welcome message's file on digital signal processor DSP0. During the playing of the welcome file, channel "0" is in the SFP state to ensure that the whole welcome message is heard by the subscriber unless he terminates the call.

The first video subsystem 2 receives the format definition data and sets up the static elements of the display as described above. "Tweeny1" is shown in Figure 8 and has a patterned background 100 defined by an image file, two video windows 101, 102 and an eliptical region 103, labelled "continue". Instructional text is also displayed and

instructs the user to press 1 to hear the audio for the lefthand video window 101, 2 to hear the audio for the righthand video window 102, # to continue to the next display and * to listen to help.

Although two video windows have been defined, the video is not played immediately because of the need to sychronize the videos with their accompanying audio files. Therefore, once the first video subsystem 2 has reported back that the display format has been set up and the audio subsystem 4 has reported the end of the welcome message with a FILE_END message, the first control process calls the interactive format server and receives a message for the first video subsystem 2 to start playing a first video file in the lefthand window 101 and a message to the audio subsystem 4 to start playing the accompanying audio using virtual multiplay group "4" of the telephony interface 44. The first control process sends these messages to their respective destinations substantially simultaneously. The processor 41 of the audio subsystem 4 real multiplay group "4" and maps it onto virtual multiplay group "1" for the first control process.

Additionally under instructions from the interactive format server, the first control process sends a message to the first video subsystem 2 to start playing a second video file in the righthand window 102 and, substantially simultaneously, sends a message to the audio subsystem 4 to start playing the accompanying audio. The audio subsystem 4 allocates real multiplay group "2" for playing the accompanying audio file for the second video window 102 and maps it onto virtual multiplay group "2" for the first control process. The dispatch of a video play message and the audio play message, for the accompanying audio, may be staggered, typically by a few tens of milliseconds, to account for differing response times of the audio and video subsystems.

When the playing of an audio file accompanying a video in a window 101, 102 finishes the audio subsystem sends a MULTI_PLAY_FILE_END message to the first control process. Similarly, the first control process is informed when the playing of

the video file finishes. When the first control process has received notification that the playing of both a video file and its accompanying audio file have finished, the first control process forwards the messages to the interactive format server. The interactive format server returns the audio and video file play commands which the first control process sends to the audio subsystem 4 and the first video subsystem 2. This keeps the audio synchronised with the video.

If the subscriber now presses the "1" key of his mobile station 27, the audio subsystem 4 identifies that "1" has been pressed by the subscriber on real channel "0" and sends a DIGIT_PRESS message to the first control processor 5a; the audio subsystem 4 identifies the correct destination control processor 5a, 5b from the channel in which the digit's DTMF signal was received. The DIGIT_PRESS message identifies the digit that has been pressed and the virtual channel corresponding to the real channel in which the digit's DTMF signal was received The first control process calls the interactive format server using the digit's identity as a parameter and is returned messages for the first video subsystem 2 and the audio subsystem 4 indicating that the subscriber wishes to listen to the audio for the lefthand video window. Accordingly, the first control process sends a "mAdd 0 1" message to the audio subsystem 4 to add virtual channel "0" to virtual multiplay group "1" and a < U:0:1:+ > message to the first video subsystem 2. The audio subsystem 4 responds to its message by adding real channel "0" to the real multiplay group "4" after accessing the virtual channel and group mapping tables. Consequently, the subscriber then hears the audio in the loudspeaker of his mobile station 27. The first video subsystem responds to its message by generating an indicum 104, representing the subscriber, adjacent the lefthand video window 101.

If the subscriber now presses the "2" key of his mobile station 26, the above process is repeated save that the messages sent to the audio subsystem 4 and the first video subsystem 2 are "mAdd 0 2" and "< U:0:2:+ >" respectively. The audio subsystem 4 responds to its message by removing real channel "0" from real multiplay group "1" and adding it to real multiplay group "2" so that the subscriber hears the audio

accompanying the video in the righthand video window 102. The first video subsystem 2 responds to its message by moving the indicium 104 to a position adjacent the righthand video window 102.

If at any time the subscriber presses the "*" key of his mobile station 26, the audio subsystem 4 identifies that "*" has been pressed by the subscriber on real channel "0" and sends a DIGIT_PRESS message to the first control processor 5a. The DIGIT_PRESS message identifies the digit that has been pressed and the virtual channel corresponding to the real channel in which the digit's DTMF signal was received. The first control process calls the interactive format server using the digit's identity as a parameter and is returned a messages for the audio subsystem 4. The first control process responds by sending these messages to the audio subsystem to remove the real channel "0" from real multiplay group "1" or "2" (as necessary) and start the help file playing on digital signal processor DSP0 which is permanently allocated to real channel "0". The first control process 56 also sends a message to the first video subsystem 2 to remove the indicium 104 from the displayed image. When the help file has finished, the audio subsystem 4 sends a FILE_END message to the first control process 56 and resets the state of real channel "0" to ACTIVE.

If the subscriber presses the "#" key of his mobile station 26, the audio subsystem 4 identifies that "#" has been pressed by the subscriber on real channel "0" and sends a DIGIT_PRESS message to the first control processor 5a. The DIGIT_PRESS message identifies the digit that has been pressed and the virtual channel corresponding to the real channel in which the digit's DTMF signal was received. The first control process receives the message and calls the interactive format server using the digit's identity as a parameter and is returned a "<U:0:3:+>" message for notifying the first video subsystem 2 that the subscriber is ready to move to the next page. The first control process 56 then sends the message to the first video subsystem 2 which responds by moving the indicium 104 into the eliptical window region.

After each message from the audio subsystem 4 has been processed by the first control process, the control process determines whether all of the subscribers using the first video subsystem 2 are ready to move to the next display format. In the present situation, only one subscriber is using the first video subsystem 2 and the first control process therefore immediately connects to the interactive format server for next display format, "Presentation Domain".

The operation of the low-level messaging between subsystems will now be apparent and will be largely omitted from the following in the interests of clarity.

When the interactive format server for "Presentation Domain" is connected to, the first control process sends the format definition data to the first video subsystem 2 which then constructs the new display. Referring to Figure 8, "Presentation Domain" comprises a background 105 defined by an image file, a video window 106 and instructional information. Initially, the image received by the antenna 24 and the tuner 25 is displayed in the video window 106 and audio from the direct audio feed 46 is fed to the real live group "7" in the audio subsystem 4. The direct audio feed 46 receives audio from another tuner (not shown) tuned to the same channel as the tuner 25 of the first video subsystem 2.

If the subscriber presses the "1" key on his mobile station 27, he will be connected to the real live group "6" and be fed the audio from the direct audio feed 46 and the first video subsystem 2 will display the video from the antenna 24, if it is not already doing so. If the user presses the "2" key on his mobile station 27, the first video subsystem 2 is instructed to play a video file from the disk drive 213 in the first window and the audio subsystem 4 is instructed to play the accompanying audio file on real multiplay group "1" and switch the subscriber's channel from real live group "6" to real multiplay group "1". Pressing the "*" key causes an audio help file to be played to the subscriber and pressing the "#" notifies the first control process that the subscriber is ready to move on.

When the subscriber has indicated that he is ready to move on, the first control process sets up the next display format, called "Tweeny2". "Tweeny2" is identical to "Tweeny1" save for the video displayed in the video windows and the accompanying audio files.

If, while "Tweeny2" is being displayed, a second subscriber calls the audio subsystem 4 using his mobile station 28, he will be played a welcome message and may then interact with the display. The second subscriber can selectively listen to the audio for the displayed video by pressing the "1" and "2" keys on his mobile station 28. The presence of the second subscriber is indicated by a further distinctive indicium in the display image.

Once a subscriber has indicated his desire to move on by pressing the "#" key on his mobile station 27, 28, his indicium will move to the eliptical region. Until the other subscriber indicates his desire to move on or terminates his call, a subscriber who has pressed the "#" key will still be able to listen selectively to the audio for the displayed video. However, when he presses the "1" or "2" key his indicium will not move from the eliptical region.

When both subscribers have indicated a desire to move on, the first control process sets up the next display format. This display format comprises an interactive game (see Figure 9) in which each subscriber has control of a snake 107, 108 on the display screen 22 and must steer their snake to "eat" objects 109 appearing at random; the more objects a snake eats, the longer it grows. The subscribers can turn their snakes to the left or the right by pressing the "4" and "6" keys on their mobile stations 27, 28 respectively.

If the second subscriber terminates his call at this point, the audio subsystem 4 sends a DISCONNECT message to the first control process. The first control process forwards this message to the interactive format server which deletes its record of the second subscriber. The first control process also deletes its record of the

disconnecting subscriber. In response to the subscriber's disconnection, the audio subsystem 4 frees the real and virtual channels allocated to the second subscriber and removes his channel from any groups of which it had been a member. The first control process also sends a message to the first video subsystem 2 causing it to delete the indicium for the second subscriber.

When the first subscriber indicates his wish to move on, the first control process sets up the next display format, called "Tweeny3". "Tweeny3" is identical to page "Tweeny1" save for the video and audio files played.

When the first subscriber indicates his wish to move on from "Tweeny3", the first control process sets up the next display format, called "Conference Domain" by connecting to the appropriate interactive format server. The "Conference Domain" format comprises two video windows which display respectively the video from the camera 26 of the first video subsystem 2 and the video from the camera 36 of the second video subsystem 3, received via the broadband link 12.

At this point, it will be assumed that a third subscriber has accessed the system from near the second video subsystem 3 using his mobile station 37 and has reached a "Conference Domain" display format on the second video subsystem 3.

The "Conference Domain" display includes a conference access code, which changes from time to time. In order to take part in a conference a subscriber must enter this code using his mobile station. When a subscriber has entered the conference access code, the relevant control process instructs the audio subsystem 4 to add the subscriber's channel to a conference group. Subscribers whose channels have been added to the same conference group can talk to other subscriber's, whose channels are members of the same group, while seeing them on their local display screen 22, 32. If a large number of subscribers are using "Conference Domains", they may be distributed amongst a plurality of conference groups to limit the number of subscribers using any one conference group.

The purpose of the conference access code is to ensure that callers using conferencing are actually near one of the video subsystems 2, 3.

When the first subscriber indicates his wish to move on, the first control process sets up the next display format, called "Tweeny4". "Tweeny4" is identical to page "Tweeny1" save for the video and audio files played.

Finally, when the first subscriber indicates his wish to move on from "Tweeny4", the first control process sets up the display format "Tweeny1" again.

If at anytime all the subscribers using one video subsystem 2, 3 terminate their calls, the relevant control process sets up that video subsystem's initial display format.

In the foregoing, the present invention has been described with reference to an embodiment in which a plurality of subscribers can interact with one video subsystem simultaneously and in which there is a predefined sequence of display formats. It will be appreciated that the display formats may comprise a web with formats having links to one or more other formats. Such an arrangement of formats is particularly suited a system having only one input audio channel per video subsystem. However, navigation through a web in a multiuser system may be achieved by acceding to the wishes of the majority with a random function to settle voting ties. With a web structure, the management subsystem would not set the order in which formats are used.

The video subsystems have been described as having a single display screen using one format at any given time. However, each video subsystem may comprise a plurality of screens, each using a different format for a different user. A plurality of screens may be used to display parts of a single image according to a single format. Furthermore, one display may be segmented to display images according to more

than one format at a time, for instance so that different users can have absolute control over the selection of formats of interest.

The distribution of video files is described as using the ISDN links 23, 33. It will be appreciated that these files may be distributed using data carriers, e.g. disks or tapes.

If a plurality of video subsystems require the same image data, this data may be distributed using a broadcast technique, for instance using a satellite, or digital or analogue terrestrial television channels.

The ISDN links 23, 33 may be replaced by telephone links, either fixed or mobile. A portable video subsystem is envisaged which includes mobile telephone apparatus for communicating with the control subsystem.

The microcomputers used to embody the various subsystems have been described in outline only. The skilled reader, however, will appreciate that these microcomputers may include additional standard elements, including disk drives, monitors, keyboards, etc.

Claims

1. An interactive display system comprising:

an audio subsystem configured for receiving audio communication signals via a wide area communications network and generating control signals in dependence on the received audio communication signals;

a control subsystem configured to respond to said control signals from the audio subsystem by issuing display commands, and

a video subsystem including display means, configured to be responsive to said display commands to display on the display means images defined by image data,

wherein the video subsystem is remote from the control subsystem and said image data is provided to the video subsystem independently of the display commands.

2. A system according to claim 1, wherein the video subsystem includes local data storage means storing said image data for display in response to the display command.

3. A system according to claim 1 or 2, wherein the video subsystem includes input means for receiving real-time video signals.

4. A system according to claim 1, 2 or 3, wherein the transmission of the display commands requires a bandwidth insufficient for the transmission of real-time video.

5. A system according to claim 4, wherein the transmission of the display commands requires a bandwidth insufficient for the transmission of real-time video having a frame rate greater than twenty frames per second.

6. A system according to any preceding claim, wherein the control subsystem is linked to the video subsystem by a communications channel having supporting a maximum bit rate of 64kbits s^{-1}, the display commands being sent via said channel.

7. A system according to any preceding claim, wherein the control subsystem is configured to respond to said control signals from the audio subsystem by issuing audio subsystem control commands.

8. A system according to claim 6, wherein the control subsystem is configured to respond to a control signal to issue both a display command for causing a moving image to be displayed by the video subsystem and an audio subsystem control command to cause the audio subsystem to make available via the wide area communications network audio signals for accompanying the moving image.

9. A system according to any preceding claim, wherein the wide area communications network comprises a public telephone network.

10. A system according to any preceding claim, wherein the wide area communications network comprises a mobile telephone network.

11. A system according to any preceding claims wherein said audio communication signals and/or said audio signals are conveyed in a telephony channel.

12. A system according to any preceding claim, including a plurality of video subsystems.

13. An interactive display method comprising the steps of:

providing a supply of images data at a remote display station;

receiving at a central station an audio communication signal via a wide area communications network and generating control signal in dependence on the received audio communication signal;

issuing from the central station a display command to the remote station in dependence on the received audio communication signal; and

displaying an image at the display station in dependence on the display command, said image including a portion defined by image data from said supply.

14. A method according to claim 13, wherein the provision of a supply of images comprises storing image data in a data storage device at the remote display station.

15. A method according to claim 13 or 14, wherein the provision of a supply of images comprises providing a receiving means receiving real-time video signals.

16. A method according to claim 13, 14 or 15, wherein the transmission of the display command requires a bandwidth insufficient for the transmission of real-time video.

17. A method according to claim 16, wherein the transmission of the display command requires a bandwidth insufficient for the transmission of real-time video having a frame rate greater than twenty frames per second.

18. A method according to any one of claims 13 to 17, wherein the display command is sent to the video subsystem by a communications channel having a maximum bit rate of 64kbits s^{-1}.

19. A method according to any preceding claim, including the step of responding to said control signal by issuing audio subsystem control commands.

20. A method according to claim 19, comprising the step of issuing substantially simultaneously both a display command for causing a moving image to be displayed by the video subsystem and an audio subsystem control command to cause the audio subsystem to make available via the wide area communications network an audio signal for accompanying the moving image.

21. A method according to any preceding claim, wherein the wide area communications network comprises a public telephone network.

22. A method according to any preceding claim, wherein the wide area communications network comprises a mobile telephone network.

23. A method according to any preceding claims wherein said audio communication signal and/or said audio signal are conveyed in a telephony channel.

24. A apparatus comprising a display and processing means configured for controlling the display according to a stored program and user input commands input via a telephone network, wherein the user input commands comprise telephone dialling signals.

25. An apparatus according to claim 24, wherein the processing means is configured for controlling the display according to user input commands input from different sources via the telephone network.

26. A system according to any one of claims 1 to 12 and claim 24 or 25.

27. A videophone system for use with mobile telephones comprising:

a first video subsystem including a display and a video camera and located in an area covered by a mobile telephone network;

a second video subsystem including a display and a video camera and located in an area covered by a mobile telephone network;

communication means for conveying signals from the video cameras between the video subsystems; and

an audio subsystem configured for receiving first and second concurrent telephone call from mobile telephones and providing an audio connection between said calls to enable the calling parties to converse.

28. An apparatus according to any one of claims 1 to 12 or 26 and claim 27.

29. A telephony interface comprising connecting means for connection to a plurality of telephony circuits, signal processing means for producing audio signals from audio signal data and switching means configured to selectively applying audio signals produced by the signal processing means simultaneously to a plurality of telephony circuits by means of the connection means.

30. A telephony interface according to claim 29, wherein the switching means is configured to selectively connect telephony circuits to each other by means of the connection means.

31. A telephony interface according to claim 29 or 30, wherein the switching means includes processing means operating under the control of a program or programs, the program or programs defining a set of switching states of the switching means.

32. An apparatus according to claim 7 or 27, including an interface according to any one of claims 29 to 31.

33. A video subsystem of a telephone-controlled interactive display system including display means, configured to be responsive to display commands from a remote control subsystem to display on the display means images defined by image data, said image data being provided to the video subsystem independently of the display commands, and means for making available to a person viewing the display means a telephone number that can be called to establish an interactive relationship between said person and the display system.

34. An interactive display system substantially as hereinbefore described with reference to Figures 1 to 5 of the accompanying drawings.

The Patent Office

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Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): H4K: KOF; KOX. H4L: LDA

Int Cl (Ed.6): G09F, G09G, H04M

Other: ONLINE: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	EP 0 337 539 A2 (TELEMA)	
A	WO 94/13092 A1 (AUMEC) Fig.7	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.